

Claims

What is claimed is:

1. A device, comprising:  
a cloud condensation nuclei chamber having an input to receive an aerosol flow, a region of supersaturation to grow cloud condensation nuclei, and an output to export the aerosol flow; and  
a thermal control engaged to said chamber to produce a monotonic thermal profile in a stream-wise direction of the aerosol flow from said input to said output in said chamber.
2. The device as in claim 1, wherein a temperature in said chamber monotonically increases along the aerosol flow.
3. The device as in claim 2, wherein the temperature of said chamber linearly increases along the aerosol flow.
4. The device as in claim 2, wherein the temperature of said chamber nonlinearly increases along the aerosol flow.
5. The device as in claim 1, further comprising a flow control mechanism to split an air sample flow into the aerosol flow and a sheath flow, wherein the sheath flow is directed to flow along inner surfaces of said chamber to keep the aerosol flow away from the inner surfaces.
6. The device as in claim 5, wherein the sheath flow has a sheath flow rate higher than a flow rate of the aerosol flow.
7. The device as in claim 1, wherein said chamber has a cylindrical shape to direct the aerosol flow along an axis of the cylinder.

8. The device as in claim 1, wherein said chamber is oriented vertically to receive the aerosol flow from the top and the export the aerosol flow from the bottom.

9. A cloud condensation nuclei measuring apparatus, comprising:

a chamber to receive an air sample and to keep said air sample in a region of supersaturation within a specified range;

a heating system providing an increasing temperature gradient along the axis of said chamber in the direction of flow; and

a particle counter coupled to said chamber to measure particles in said air sample output by said chamber and to provide a count indicative of particles within a selected size range.

10. The apparatus as in claim 9, further comprising a flow control mechanism to provide a sheath flow around the air sample in said chamber and to keep the air sample away from side walls of said chamber.

11. The apparatus as in claim 10, wherein a ratio of a flow rate of the sheath flow over a flow rate of the air sample is controlled between about 5 and 20.

12. The apparatus as in claim 10, further comprising a heating element to heat the sheath flow at a temperature above a temperature of an end of the said chamber that receives the air sample.

13. The apparatus as in claim 9, wherein said chamber has a wetted inner surface.

14. The apparatus as in claim 13, wherein said chamber has a layer of a filter paper on the wetted inner surface.

15. The apparatus as in claim 13, wherein said chamber has a layer of a porous ceramic material on the wetted inner surface.

16. The apparatus as in claim 9, wherein said particle counter includes an optical particle counter.

17. The apparatus as in claim 9, wherein temperatures along the axis of said chamber linearly increase.

18. The apparatus as in claim 9, further comprising a second chamber to receive a second air sample and to keep said second air sample in a region of supersaturation within a specified range;

a second heating system providing an increasing temperature gradient along the axis of said second chamber in the direction of flow; and

a second particle counter to measure particles in said second air sample output from said second chamber and to provide a count indicative of particles within a selected size range.

19. A thermal gradient diffusion chamber for inclusion in a cloud condensation nuclei measurement apparatus comprising a heat source to create an increasing temperature gradient in the direction of flow of an air sample in said chamber.

20. The chamber in claim 19, wherein said chamber has a wetted inner surface.

21. The apparatus as in claim 19, wherein temperatures along the axis of said chamber linearly increase.

22. A method for conditioning a sample in a cloud condensation nuclei measurement apparatus, comprising:  
subjecting a sample passing through a column; and  
subjecting said sample to an increasing temperature gradient in the direction of sample flow.

23. The method as in claim 22, further comprising using a sheath flow around the sample flow to keep the sample flow away from inner surfaces of the column.

24. The method as in claim 22, further comprising maintaining inner surfaces of the column wet with water.

25. A method, comprising:  
directing an aerosol flow through a cloud condensation nuclei chamber to grow particles due to condensation from supersaturation; and  
controlling a temperature profile of the chamber along the aerosol flow to produce a nearly constant supersaturation along the chamber.

26. The method as in claim 25, further comprising providing a sheath flow around the aerosol flow to reduce particle loss caused by contact of particles in the aerosol flow and inner surfaces of the chamber.

27. The method as in claim 25, wherein a temperature of the chamber increases monotonically along the direction of the aerosol flow.